



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/803,910	03/19/2004	Seiichi Higaki	ASAM.0115	6368
7590 REED SMITH LLP Suite 1400 3110 Fairview Falls Church, VA 22042		06/21/2007	EXAMINER PATEL, KAUSHIKKUMAR M	
			ART UNIT 2188	PAPER NUMBER
			MAIL DATE 06/21/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/803,910	Applicant(s) HIGAKI ET AL.	
	Examiner Kaushikkumar Patel	Art Unit 2188	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-51 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-51 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12/8/05 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/3/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. This Office Action is in response to applicant's communication filed April 27, 2007 in response to PTO Office Action mailed December 27, 2006. The applicant's remarks and amendments to the claims and/or specification were considered with the results that follow.
2. In response to last Office Action, claims 21, 31 and 37 have been amended. No claims have been canceled. No claims have been added. As a result, claims 21-51 remain pending in this application.

Response to Arguments

3. Applicant's arguments filed April 27, 2007 have been fully considered but they are not persuasive. In response to applicant's arguments regarding Hirakawa, Mogi and Guha, it should be noted that the rejection of claims is 35 U.S.C. 103 rejections. The applicant has presented arguments relevant to a 102 rejection. The combination of the prior art relied upon in a 103 rejection should teach the claimed invention. Applicant argues that Hirakawa does not teach multiple layers of logical volumes, Examiner fully agrees with the statement and for that reason, Examiner cited Mogi to teach advantages of using layered logical/virtual volumes and thus the motivation to use layered logical volumes. Mogi is not relied upon to teach change-over command, thus applicant's arguments that Mogi does not teach changing the mapping is irrelevant, Mogi is relied upon to teach layered logical volumes. Applicant further argues, Guha

Art Unit: 2188

does not teach powering of disk drive based on changeover command, but instead teaches cached storage. Examiner respectfully disagrees with that. As per applicant's disclosure, fig. 1, item 1-11, fig. 2, item 2-11 teaches cache, similar to Guha's cache, and applicant's disclosure further teaches use of cache improves performance of the storage system (present application specification, page 13, lines 11-17, "The cache memory 1-11 serves to temporarily store data which the host computer 1-2 may access. As the cache memory 1-11 can access data at a faster rate than HDD 1-6, the cache memory 1-11 contributes to improvement in the access performance (particularly responsibility to commands) of the storage control device"). As well known in the art that caches have finite amount of storage capacity (i.e. less than the disk based storage systems) and thus, the combination as a whole considered (Hirakawa, Mogi and Guha), when the host is mapped to first inner logical volume, the read cache (Guha) can store some amount of data from the inner logical volume and not all the data from all the inner logical volume, if that is true then the cache has to be the same size of all the inner logical volumes, which is practically not a cost effective solution, thus a portion of data is stored in the cache from mapped inner logical volume and when, the change over is requested, the disks mapped to second inner logical volume may be accessed, which inherently teaches activating disks based on change-over command. This is also taught in applicant's disclosure as explained above (i.e. if data is in the cache than the host receives data from the cache and there is no need for change-over). Thus, as explained above, Hirakawa teaches a changeover command with virtual volumes (virtual volumes do not have actual memory regions) and Mogi is relied upon to teach layered volume

approach. Guha is relied upon to teach starting/stopping disks based on necessity (i.e. when needed, the change-over command starts/stops the operation of the disks). Thus, what is required is that the combination of the references must teach the claimed invention. This burden has been met as illustrated in the last office action by combining Hirakawa (relied upon for change-over command), Mogi (relied upon layered logical volume feature not taught by Hirakawa, thus, Mogi does not need to show change over command) and Guha (relied upon to teach start/stop disks based upon usage by the user and do not need to show, layered logical volumes). Thus, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Information Disclosure Statement

4. The information disclosure statement (IDS) submitted on January 03, 2007 has considered by the examiner.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 21-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirakawa et al. (US 2002/0188768 A1), Mogi et al. (US 2003/0229645 A1) and Guha et al. (US 2004/0054939 A1).

As per claim 21, Hirakawa teaches a storage control device (fig. 2) comprising:

a channel adapter operatively coupled to a computer (Hirakawa, fig. 2, item 110, and connections 240 connects host computer) provides logical volumes for the computer and to receive data which are sent from the computer to the logical volumes (Hirakawa, par. [0036]);

a memory operatively coupled to the channel adapter to store the data sent from the computer and configuration information with respect to a configuration of the storage control device (Hirakawa, fig. 2, items, 130, 140, pars. [0038] – [0041]);

a disk adapter operatively coupled to the channel adapter and memory, to control reading and writing of the data from/to the memory and used as storage regions for transmission and reception of the data between the channel adapter and the disk adapter (Hirakawa, fig. 2, item 120, par. [0037]);

a plurality of disk drives, operatively coupled to the disk adapter, in which data sent from the computer are written by the control of the disk adapter as a data group (Hirakawa, fig. 2, item 150).

Hirakawa fails to teach multiple layers of logical volumes, such as one or more upper logical volume of the plurality of upper logical volumes are mapped to plurality of inner logical volumes provided by disk devices. Mogi teaches hierarchical multiple upper

Art Unit: 2188

volumes (Mogi, fig. 2, item 204, 206) and multiple inner logical volumes (Mogi, fig. 2, item 208) and upper logical volumes are mapped to inner logical volumes.

It would have been obvious to one having ordinary skill in the art at the time of the invention to use hierarchical volumes as taught by Mogi in the system of Hirakawa to allow transparent and dynamic storage allocation and isolate the internal structure of a logical volume from the logical volume perceived by a host (Mogi, pars. [0008] – [0010]).

Wherein a first inner logical volume of the inner logical volumes is mapped to a first upper logical volume of the upper logical volumes and is mapped to a first set of disk drives in the plurality of disk drives (Mogi, fig. 2), a first data group targeted to the first inner logical volume being written into the first set of disk drives (It is inherent in the system of Mogi, when data is read/written from the logical volume, the subsequent data is read/written to set of disk drives that are mapped to the particular logical volume);

Hirakawa and Mogi teach a changeover command to remap the upper logical volume connected to the first inner logical volume to a second inner logical volume (Hirakawa, par. [0051], Mogi, pars. [0010], [0012] and [0015]). It is inherent in the system of Hirakawa and Mogi that after the execution of remapping command the upper logical volume is disconnected from the first inner logical volume and connected to second inner logical volume (Mogi, fig. 7).

Hirakawa and Mogi fail to teach starting of second set of disk devices and second upper volume to store changeover instruction. Guha teaches starting and stopping the disk devices (Guha, pars. [0065] and [0133] – [0136]). Guha also teaches

that the configuration information regarding I/O operations and disk drive operational transitions (i.e. powering up or down etc.) are kept as metadata volume (second upper volume to store change-over instruction). So, in order to access or to power up other volume group and to power down the current volume group (which will not be used), one have to access the configuration information from/to the metadata volumes, which inherently teaches utilizing second upper logical volume for control to change volume mapping as well to power up and power down respective disk drive groups.

It would have been obvious to one having ordinary skill in the art at the time of the invention to use method of starting/stopping disk drives and metadata volume as control volume as taught by Guha in the system of Hirakawa and Mogi to improve the system reliability by decreasing disk failure rate (Guha, pars. [0020], [0027]) and improve the system performance by using metadata volume because a separate metadata volume provides rapid search of system configuration (Guha, par. [0157]).

With respect to limitation, wherein activation of the second set of disk drives that are mapped to the second inner logical volume starts in response to change-over from the first inner logical volume to the second inner logical volume, the limitation is inherent in the combined system of Hirakawa and Mogi, because when mapping change command is issued in the system of Hirakawa, the activation of second set of disk drives is must in order to access the disk drives. Guha teaches caches storage system, but caches with limited size can not store all the data from all the volumes, which inherently requires accessing second set of disks because initially when host is accessing data from first inner volume, data from the second inner volume may not be

present in the cache (due to limited small size of the caches) and thus when mapping change may require accessing second set of disk drives (which is evident from applicant's own disclosure, page 13, lines 11-17, "The cache memory 1-11 serves to temporarily store data which the host computer 1-2 may access. As the cache memory 1-11 can access data at a faster rate than HDD 1-6, the cache memory 1-11 contributes to improvement in the access performance (particularly responsibility to commands) of the storage control device").

As per claim 22, Guha teaches that the disk drive group, which was previously accessed by the host, is powered down (stopped) after mapping change to access a new volume group (Guha, pars. [0133]-[0136], taught as single disk drives, but as mentioned in fig. 1 and in par. [0133], a container can be a single disk or multiple disk volumes).

As per claims 23, 24, and 25, Guha teaches that the disk drive group not used, is powered down (Guha, abstract, fig. 1, and pars. [0065] and [0133]-[1036]) and Guha maintains all virtual to physical volume mapping information and disk operational activities (powering on and off) as a metadata volume (pars. [0114] and [0149]). Mogi teaches that inner logical volume can map to multiple upper logical volume (Mogi, fig. 2) thus, it inherent in the system of Guha and Mogi that there can be multiple disk drive groups are stopped or running (powered off or based on usage) and also one group of drives are mapped to multiple upper volumes so it is necessary to check after and

before mapping change whether newly mapped disk drive sets are being used by the some other upper volume and if so the newly mapped drives are running and there is no need to start those disk drives and also to check if previously mapped disk drives are mapped to another upper logical volume or not in order to stop the drives if they are not used by other volume. Thus it would have been obvious to one having ordinary skill in the art at the time of the invention to access the metadata volume information to determine whether the volume group is being used or not used, and after the determination, if it is judged that mapping to new volume group was accessed by other upper logical volume then the disk spindles are kept spinning and if newly mapped inner volume was not used than the disk drives mapped to that volume were stopped and there is need to start those disk drives and if there is no existing mapping relation between previously mapped disks than, those disk drives were not in use and hence must be stopped.

As per claim 26, Guha teaches a storage system with virtual volumes and all the mapping information related to I/O operation and disk operations (on/off) is kept as metadata (paragraph [0114]). Guha inherently teaches that all the metadata information has to be updated (related to powering on and off the disk drives as well as volume mapping changes) and thus to update the metadata volume regarding powering on newly mapped drive and powering down previously mapped drive inherently teaches write command (updating of metadata volume information as one volume group is powered down and other volume group is powered up) as a indication of change-over.

As per claims 27 and 29, Guha teaches that one volume group is (written to or read from) is powered on and the other volume group is (not being used after volume change) is powered off (see abstract). It is inherent that the system distinguishes between the command sent from host as reading data from volume groups or reading configuration information from metadata volume in order to change mapping relation to access different volume group than currently mapped volume group to host.

As per claim 28, Guha teaches selectively powering on disk volume group, which is being used and powering down disk volume group, which is not used as explained in claim 1, above which inherently teaches power control device to control power supplied to disk spindles.

As per limitations of claim 30, it is apparent that storage devices are used for plurality of applications, such as backup, restore, archive etc (see present application specification, background of invention) and depending upon the application of storage device the inner logical volumes can contain same group of data or different group of data.

Claims 31-51 are also rejected under the same rationales as applied to the claims 21-30 above.

Conclusion

7. The examiner also requests, in response to this Office action, support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line no(s) in the specification and/or drawing figure(s). This will assist the examiner in prosecuting the application.

8. When responding to this office action, Applicant is advised to clearly point out the patentable novelty which he or she thinks the claims present, in view of the state of the art disclosed by the references cited or the objections made. He or she must also show how the amendments avoid such references or objections See 37 CFR 1.111(c).

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaushikkumar Patel whose telephone number is 571-272-5536. The examiner can normally be reached on 8.00 am - 4.30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hyung Sough can be reached on 571-272-6799. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



kmp
June 11, 2007

Kaushikkumar Patel
Examiner
Art Unit 2188

GARY PORTKA
PRIMARY EXAMINER

